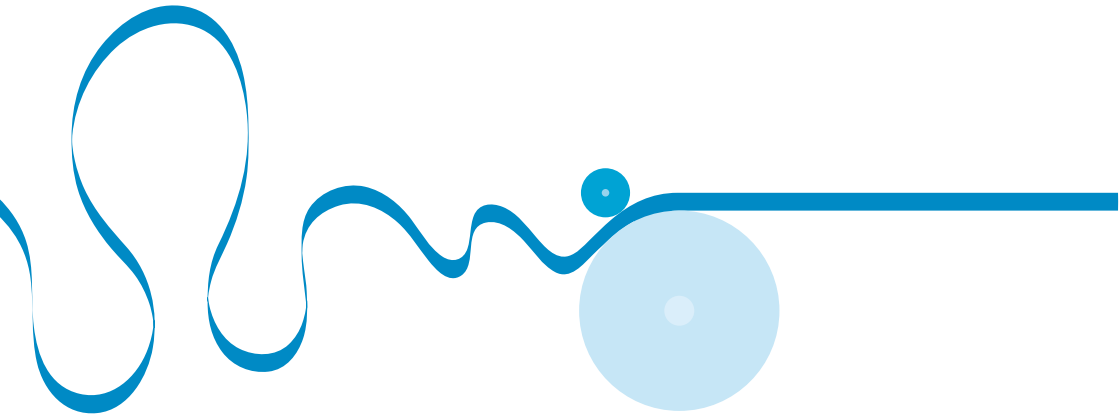

capstan

wow and flutter removal

user manual

Capstan user manual rev 1
This documentation refers to Capstan 1.0
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Welcome!

Many thanks for your interest in Capstan and a warm welcome to the circle of Capstan users!

Capstan is an all new method to correct wow and flutter problems. It detects pitch problems directly from the inside of the musical signal and corrects them as straightforward as possible: by speeding up and down the playback of your audio file directly reciprocal to the speed changes which generated the problems.

We at Celemony have worked hard to make Capstan as pleasant to use, as powerful, and as useful as possible. Let us know how you like it and what we could improve. And don't hesitate to contact us if anything doesn't work quite the way it should – at capstan@celemony.com we're always there for you.

We hope your work with Capstan will be productive and that you'll have fun with it at the same time!

Kindest regards,
all at Celemony

Installation and activation

Installation and terminology

Capstan is very easy to install: just launch the installation program (either from the program CD or the download) and follow the onscreen instructions. The whole installation takes, at most, a few minutes. Before using the program, however, you must register and activate Capstan. Here is a brief explanation of the terminology:

Serial number: Your serial number represents your license for Capstan.

Registration: Registration involves the creation of a user account linked to your serial number. You set up such an account at www.celemony.com/mycelemony, where online instructions will guide you. If you purchased Capstan from our web shop, the registration is already complete.

Activation: Once registered, your Capstan license must be transferred to an iLok. This means, Capstan can only be used when you own an iLok dongle, which is sold separately in every pro audio music shop.

Connect the iLok dongle to your computer and proceed like this:

1. Go to your myCelemony account and use the option “Transferring your license to your iLok account”. At this stage you will be asked for your iLok account name. If you don’t have one yet, go to www.iLok.com and create an account.
2. In your account at iLok.com navigate to “new licenses available”. There you will find the Capstan license waiting for you. Download it to your iLok dongle by following the onscreen instructions.

After this procedure you will be able to activate and operate Capstan on any number of different computers, but only on one at a time: that is to say, only on the computer in which the dongle is inserted.

Demo mode

When no iLok license is found, Capstan can be used in Demo mode. In this mode you can import files of any length. Playback is possible for only 7 seconds at a time, though, then playback will stop. Furthermore the saving of a .capstan file and file export is not possible.

How Capstan works

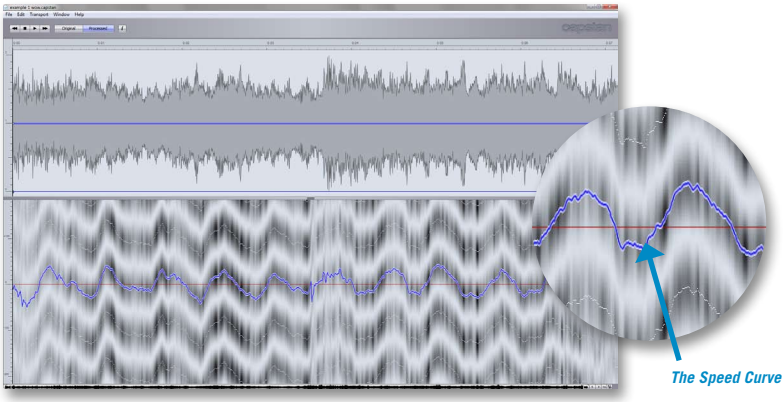
Capstan looks inside the music. It analyzes the polyphonic content and compares the individual notes. If a pitch movement is found only in one voice, it is taken as an intended musical expression by the performer. Such pitch movements should remain untouched. But if a pitch movement is identical or dominant in all notes, it must be coming from the recording medium and needs to be corrected.

The more complex the music is in terms of polyphony, the easier it is for Capstan to find all necessary corrections automatically. This makes Capstan's fields of application reach from classical Orchestral music to Pop or Rock recordings, mainly being used on complete mixes.

The less polyphonic the music is, the more manual help is needed. Further down you will find detailed suggestions on how to deal with such rather complicated material.

Detection first, repairing later – the governing principle

How does Capstan manage to find the speed deviations in your audio material? The answer (or the crux of it) is this: through its analysis of the material. As soon as audio is loaded into Capstan, it examines the entire file and seeks to detect the musical tones within it. It then decides which pitch movements are intentional vibrato effects by the performers and which pitch movements are caused by defects of the medium – be it a tape, record or wax cylinder. The resulting Speed Curve of your medium will be displayed blue in the lower pane. When the line goes up the original material speeds up, resulting in higher pitch, and when it goes down your material slows down, resulting in lower pitch.



The Speed Curve

This detection process takes place shortly after the file is loaded. The time required for this depends upon the processing power of the computer and upon the length and musical complexity of the file. If you want to stop the detection process, simply close the window.

The need for this analysis explains why Capstan cannot operate as a real-time effect like a Denoiser or Declicker: only when the analysis is complete, the Speed Curve can be displayed. The correction though does work in real time: every alteration you make to the process in Capstan can be heard instantly – with no delay.

How the correction works

Once Capstan knows the Speed Curve of your audio material, it will vary the playback speed of your audio file. When your audio speeds up, it will slow down the playback, and vice versa. It's a pure resampling process. There is no pitch shifting or time stretching involved which could harm your audio quality.

File formats

Capstan imports and exports all common mono and stereo audio file types in bit rates between 16 and 32 bit, both fixed and floating point. It can work on sampling rates up to 192 kHz.

Capstan stores its detection data and your edits in a .capstan file which will be saved next to your audio file. When opening a .capstan file, the program will always assume the corresponding audio file at the same location.

Tutorial

In most cases Capstan will do its job almost automatically. To give you a smooth learning curve for the more complicated cases, we prepared short audio files which show common pitch defects. You find them in the "Examples" folder at this location:
Win: C:\Users\Public\Documents\Celemony\Capstan\Examples
Mac: Users/Shared/Documents/Celemony/Capstan/Examples

Additionally to the *.wav files we included our *.capstan files, so you can compare your edits with our preparations.

Wow

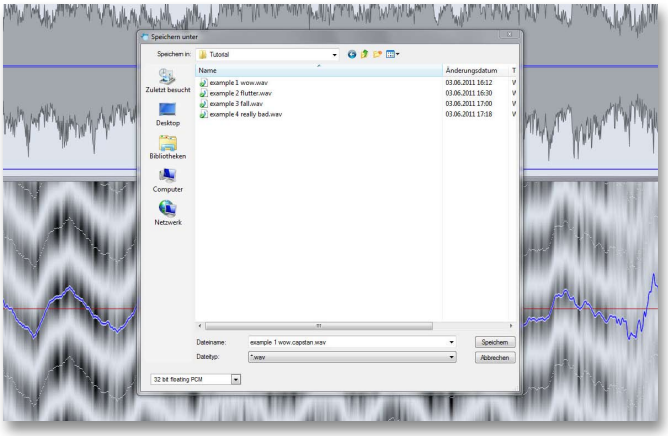
Please load "example 1 wow.wav" by loading it through the Open dialog from the File menu. After the analysis took place you see the slow speed changes displayed in the lower pane. To hear the original file first, press "O" and hit the Space Bar. Now compare it to the processed version: hit the Space Bar to stop, press "P" and hit the Space Bar for playing back again. Now you listen to the corrected version, as it came out after the analysis (without any other editing actions taken by you).

To toggle between original and processed version you can also switch between "O" and "P" while playback is running.

In this audio example Capstan obviously has little problems to find the right Speed Curve; the problem is repaired instantly – all you needed to do was loading, waiting for the analysis to finish and playing back as "Processed".

Now that you are happy with the result you might want to export your restoration. Select Export from the File menu and export it to your desired destination. Alternatively use Ctrl-E on Windows or Cmd-E on Mac.

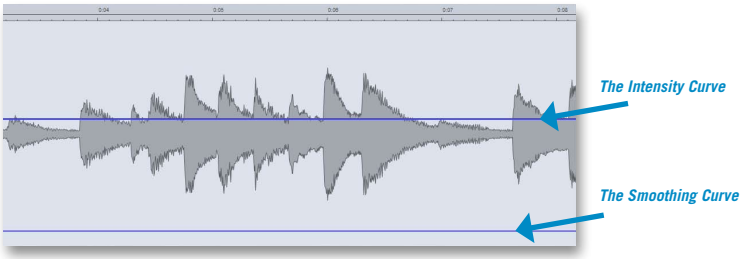
Please note that you can select the desired output bit depth in the lower left corner of the Export dialog.



The Export Dialog

Flutter

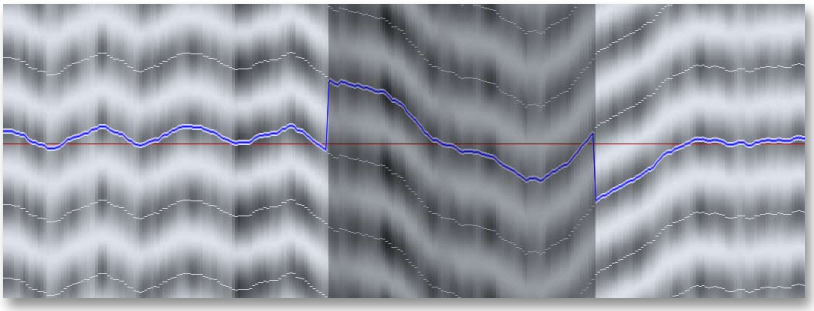
The next case is the flutter problem of “example 2 flutter.wav”. You notice that again Capstan does a splendid job finding the proper Speed Curve. But it still shows some disturbance. That’s because, in this specific example, Capstan simply doesn’t do enough of its correction. To rise the intensity of the process click on the thicker blue line in the middle of the upper waveform pane and drag it upwards. Additionally, a little smoothing of the Speed Curve helps. Select the Smoothing Curve – that’s the thinner blue line below – and drag it upwards little by little. Compare your editing with the “example 2 flutter.capstan” file from the Examples folder.



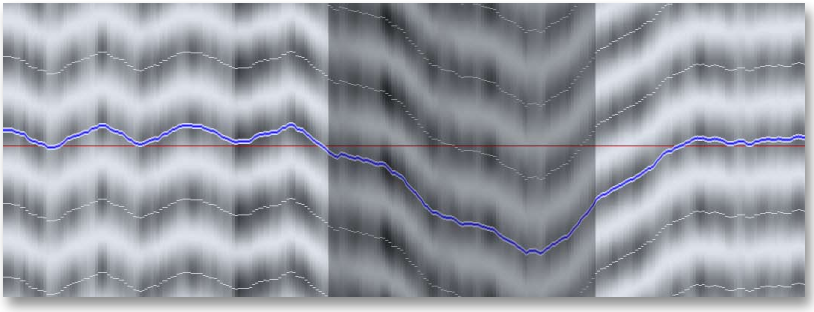
Identifying the Intensity and Smoothing Curves

Speed drop

Capstan will always choose the nearest line next to the given reference tone. In “example 3 fall.wav” you can already see in the background structure, how far the speed drops shortly before second 8. The background shows the analyzed dominant pitch curve, with parallel lines semitones apart. As the pitch falls down at a certain point the Speed Curve jumps up to the next semitone, because it is closer to the reference tone (the straight red line). Draw a range between the jump up and the following jump down and drag the blue Speed Curve down. It will snap to the next and here correct semitone.



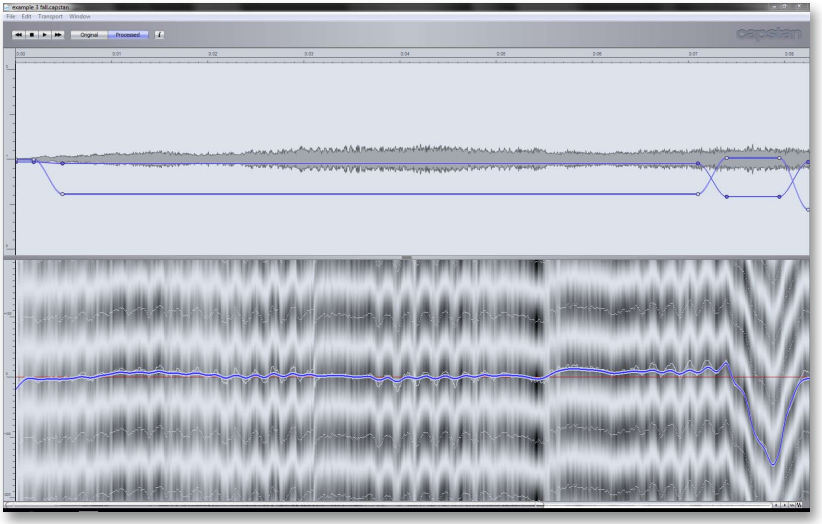
Before Speed Curve edit



After Speed Curve edit

As noted before in the section “How Capstan works” Capstan works best when the music is complex. In this example we have a static string background with a solo viola playing vibrato. This vibrato is so dominant that Capstan takes it for the Speed Curve. As there are hardly any defects outside this one big pitch drop, one can reduce Capstans intrusion through modifying the intensity and smoothing

curves. Compare your settings with the “example 3 fall.capstan” file. There are several possible solutions.



Removing unwanted correction

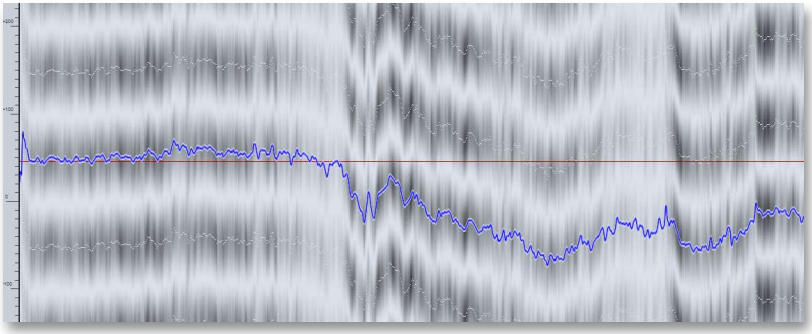
Notice how the Intensity and Smoothing Curves cross. You can distinguish those lines by their shape: the Intensity Curve is thicker and white in the middle. You also have the option to check and select the curves in the Inspector. Please refer to the chapter “Inspector”.

Fixed pitch

By default, Capstan calculates the average pitch from your audio file and plays it back on this reference pitch. The resulting file has the same length as the original file. When things go really wild, you’ll need to tell Capstan a definitive reference tone to use. Load “example 4 really wild.wav”. First thing you notice is the jump of the Speed Curve at 2.5 seconds which persists until the end. Draw a range of any lenth beginning at the jump. When you then shift-double-click on the right-hand side of the range it will be extended until the end. Now move the Speed Curve one semitone down by hitting the down arrow key.

When you now play back the processed audio you notice a drop in overall pitch. Open the Inspector (either from the File menu, the “I” button on top of the

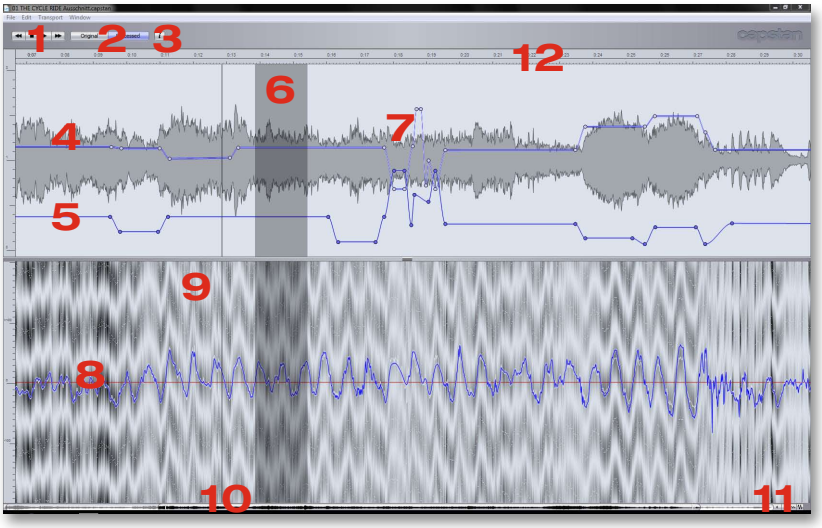
window or via the shortcut Ctrl-I on Windows or Cmd-I on the Mac) and select the pitch window. There are several options to choose from. You see that “use fixed average pitch” is selected and that Capstan calculated a reference pitch around 430 Hz. This is surely to low. To correct this, select “use fixed pitch” and type in 443 Hz, that’s the reference “a” this recording was made with.



Use fixed pitch

Main Window

The elements



The Main Window

1: Transport

You can operate Capstan just like a tape machine and play forwards as well as backwards in different speeds. There are several ways in Capstan to play sound:

- Use the mouse and click the transport buttons.
- Position the playhead cursor by clicking in the background of either the upper or lower pane or the timeline ruler. Then press the space bar to start playback.
- Double-click in the timeline ruler to start playback right away from the clicked spot.
- Use the standard Avid[tm] shortcuts “J”, “K” and “L” on your keyboard. “J” and “L” will play backwards and forwards. Hitting these keys several times in a row will increase the speed to 2x, 4x and 8x (fast forward or reverse playback). To pause, press “K”.
- For slow-motion playback hit “N” or “M”. First time will play at ¼ playback rate, second time at ½ rate.

2: Original/processed
Use these buttons to toggle playback of your original audio or the processed audio. Alternatively use the keys “O” for original and “P” for processed. Shift-O and Shift-P will play again from the position of the last playback start. When switched to original the Speed Curve will be grayed out.

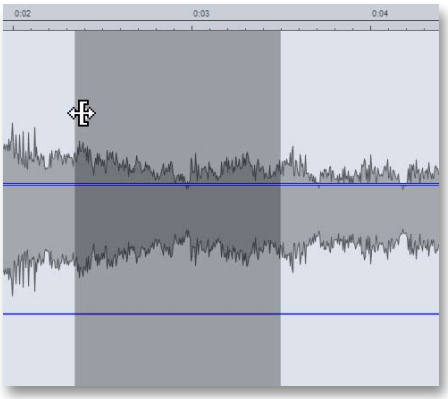
3: Inspector
This button opens an additional window; please see chapter “Inspector”.

4: Intensity Curve
Increases or decreases the amount of correction. Default value is 1. A value of 0 means there is no processing at all, your audio sounds like the original.

5: Smoothing Curve
Filters out faster changes of the Speed Curve. Default value is 0.

6: Range
To draw a range, click and drag in the background of either the upper waveform pane or the lower pitch pane. Holding the mouse over the edge of an existing range changes the mouse cursor to a range modifier. To extend the range to the end or the beginning, shift-double-click outside the existing range.

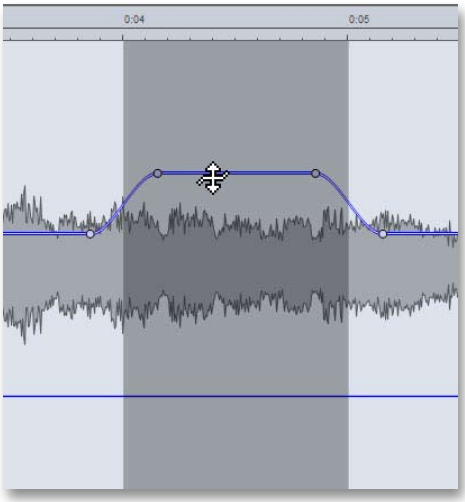
In the waveform pane a range can be drawn with finest resolution. In the lower pitch pane the range will always snap to places logical to the detection process.



Extending the range

7: Curve points
Both, Intensity and Smoothing Curves, can be automated. When you have drawn a range, simply drag the curve in the desired direction. There will be 4 curve points created automatically.

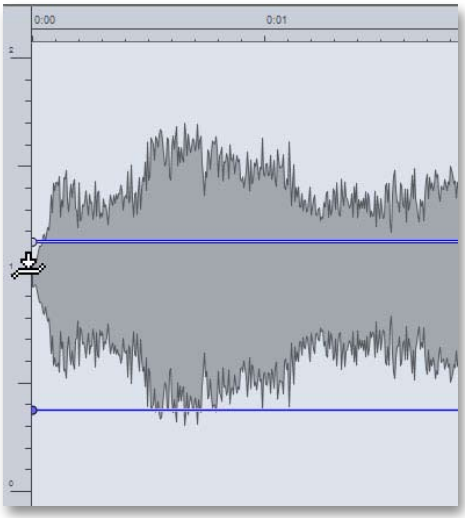
When you drag the curve while playing back, the playback will automatically start again.



Editing the Intensity Curve within a range

A double-click on the curve will create a curve point. A double-click on an already existing point will delete it. If the curve point is inside a range, all other points in this range will be removed along with the deleted one.

To reset the complete curve, double-click in the scale ruler on the left side of the waveform on the default curve positions (the mouse cursor will change its shape). For resetting the Intensity Curve double-click at value 1, for resetting the Smoothing Curve double-click at value 0.



Resetting the Intensity Curve by double-clicking the left ruler on „1“

It is also possible to reset only a part of the curve to the default values. For this approach you first draw a range and then double-click on the appropriate spot on the left ruler. The reset will then only be done only for the selected range.

8: Speed Curve
This is the core of Capstan. After Capstan analyzed the musical content of your audio file, it will display this blue line. When the line goes up it means an acceleration of both, pitch and tempo, had happened in your original material. When the curve goes down, this indicates a deceleration. To correct the speed problem of your audio source, Capstan plays back the audio file with the inverse Speed Curve. In other words: when your original material speeds up, Capstan speeds it back down and vice versa. That way you get a perfect correction of your recording. For editing the Speed Curve refer to the next chapter.

8b: Pitch reference
The red line represents the pitch reference to which Capstan corrects your audio. In the Inspector you find several choices how the reference is built. Please refer to the chapter “Inspector”.

9: Pitch pane background
The background structure of the lower pitch pane illustrates the pitch development. It helps you to identify spots where you would need to edit the Speed Curve. For example, if the pitch drops really hard, the Speed Curve will suddenly jump from one semitone to the next.

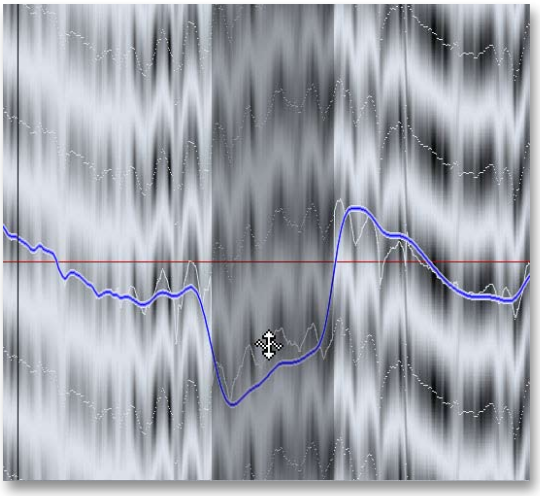
10: Navigation: scrolling and zoom
For navigating in your material there are several possibilities:
- Call up the Hand Tool by Ctrl-clicking (Windows) or Cmd-clicking (Mac) in the background of any of the two panes and drag the mouse. Drag to the left and right to move inside your file, drag up and down to zoom in/out horizontally.
- Move the scrollbar at the lower end of Capstans main window to the left or right to move inside your file. Alternatively you can use the two buttons (with the small arrows) on the right-hand side of the scrollbar to move left or right.
- Click and drag the ends of the scrollbar to zoom in and out horizontally. Double-clicking the scrollbar will zoom out completely.
- Horizontal zooming can also be done with the shortcuts Ctrl-left/right-arrow (Win) or Cmd-left/right-arrow (Mac)

11: Pitch pane vertical zoom
In certain situations you may want to zoom in vertically, e.g. when adjusting drastic jumps in the Speed Curve. A vertical zoom is performed with the two buttons (with the waveform symbol) on the right-hand side of the scrollbar or with the shortcuts Ctrl-up/down-arrow (Win) or Cmd-up/down-arrow (Mac).

12: The timeline ruler
The time ruler displays the positions in your file in seconds. You can use the ruler for setting up a cycle, in order to play back a selected passage repeatedly (in a 'loop').
Define the cycle range by clicking and dragging in the lower part of the Bar Ruler.
Toggle Cycle Mode on and off by double-clicking on the cycle range. When inactive, the cycle range is light grey.
Change the Cycle length by dragging the right- or left-hand borders of the cycle zone.
Move the Cycle range en bloc by dragging the middle of the cycle zone to the left or right.
With all the above actions you will notice that the cycle borders snap to 1/10th seconds. To get a finer resolution hold the Alt-key while dragging.

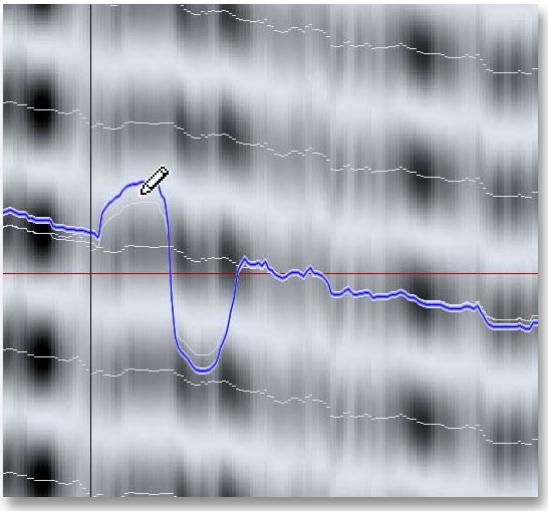
Editing the Speed Curve

Editing the intensity or smoothing curves is actually changing the Speed Curve. This process can easily be heard and seen (the curve changes its shape). In addition to using the Intensity and Smoothing Curves you sometimes want to directly modify the Speed Curve itself. Therefore it is possible to move parts of the Speed Curve up or down. To do so, specify a range and move the curve either by dragging it with the mouse or by using the up/down arrow keys. The curve then will snap to the next semitone(s).



Moving a section of the Speed Curve up or down

For super-special cases one can also directly draw the Speed Curve with a Pencil Tool. Hovering the cursor over the Speed Curve changes its appearance into such a pencil. Now click, hold and drag the mouse to draw a new curve.



Editing the Speed Curve with the Pencil Tool

Please note that your intensity and smoothing values will be applied to your drawing. Only in default intensity and default smoothing settings will the drawing be applied like you created it. You will notice a thin white line beneath the Speed Curve, though. This is the originally detected Speed Curve without any intensity or smoothing changes.

Resetting the Speed Curve to the original detection is possible by using the command “Reset Speed Curve to Detection” in the Edit menu. This resets the whole curve. If you draw a range the command reads “Reset Speed Curve to Detection in Selection” and resets only the part you selected.

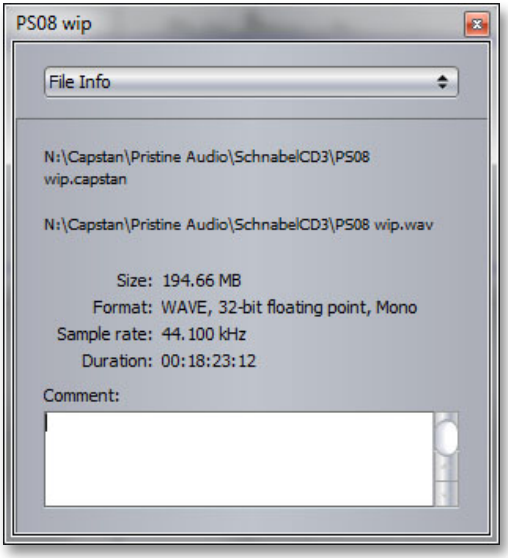
Please note: This command does not reset the edits done with the Intensity and Smoothing Curve. Those edits can be reset individually (as described earlier).

Inspector

The Inspector is a floating window with four registers providing you with detailed information and specific settings for your current file. Even if you have opened multiple files, you will only see one Inspector, which changes its content depending on the active window.

The File Info register

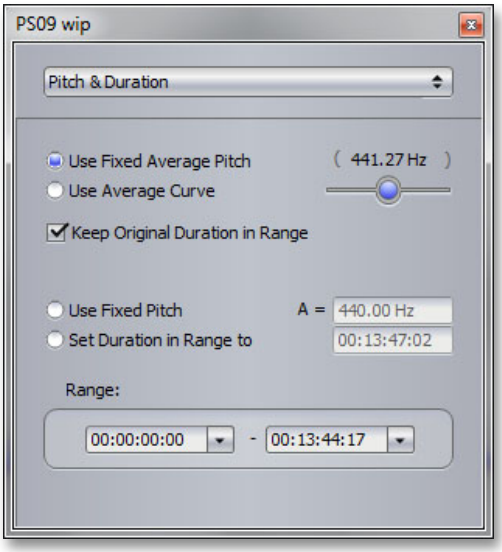
The File Info shows the location of both, your audio and capstan files, as well as the technical specifications of your audio file. In the Comment space you can write own annotations, which will be saved with your *.capstan file.



Displaying the File Info

The Pitch & Duration register

The Pitch & Duration register is a very important one. Here you define the tonal aim of your correction.



The Pitch and Duration register

Use Fixed Average Pitch

By default Capstan will analyze the pitch of your whole audio file and calculate the a fixed average pitch. This pitch will be used as the constant reference to fix your music. The result of “Use Fixed Average Pitch” will be a file with the exact same length as your original.

Use Average Curve

The option “Use Average Curve” is for special cases: as an example, imagine a choir a cappella which is always floating a little around the reference. With this option you can track the slow movement of the reference and correct it to this target. Set the integration time for the average measurement with the slider.

Keep Original Duration in Range
The average curve option can be combined with the option “Keep Original Duration in Range“: then the average curve as a whole will be multiplied with a factor to keep the duration identical.

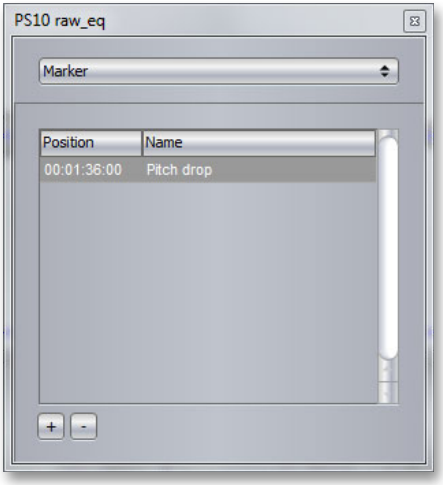
As “Use Average Pitch” will always give an identical duration, this option will be checked automatically when “Use Average Pitch” is selected.

Use Fixed Pitch
Often you will want to define a fixed pitch, especially when you know exactly at which reference the performers were tuning their instruments to. In such case chose “Use Fixed Pitch” and type in the desired reference pitch. You then get a perfect correction of all pitch problems, including shrinkage of the complete tape.

Set Duration in Range to
When you need your audio to be synchronized to a picture, the option to set a duration comes in handy. You would then specify the “Range” by typing in start and end point in the corresponding Range fields at the bottom of the panel. Then you choose “Set Duration in Range to” and define the duration of your destination by typing in the desired value.

Range Start and End
Specify the range by typing in the desired positions. The displayed timecode standard displayed is set in the View register of the Inspector. Instead of typing in the values you can also transfer the actual time position of your playhead cursor by using the drop down menus of the start and end fields.

Marker



The Marker register

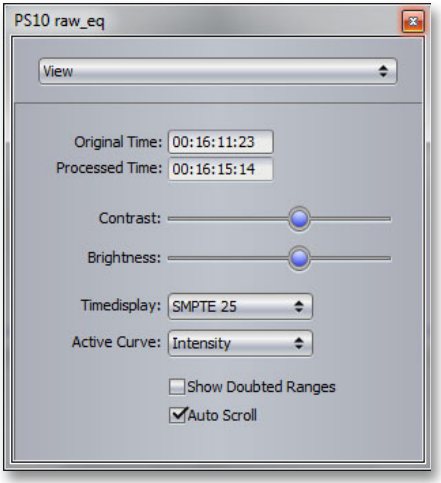
For adding comments and reminders to certain spots in your audio file you can set markers. In the Marker register of the Inspector you can set a marker by clicking the “+” button.

To call up a marker, simply click it (while playback is stopped). The playhead position will then jump to the corresponding position.

Name or rename a marker by double-clicking its name and delete the marker by clicking the “-” button.

To change the position of a marker double-click on it in the Position column and type in a new value.

View



The View register

Original and Processed Time
Original Time shows the actual timecode position in your original audio.
Processed Time shows you the actual timecode position in your processed audio.

Contrast and Brightness
The Contrast and Brightness sliders help you to change the visibility of the lower pitch pane background structure.
Timedisplay
Timedisplay changes the timecode standard.

Active Curve
Active Curve helps you to identify and select the curves in the upper waveform pane, especially when those curves cross each other.

Show Doubted Ranges
Show Doubted Ranges will display sections in your Speed Curve where Capstan spotted ambiguous pitches. It can help you with identifying problems in harder cases. Doubted Ranges can also be shown via the shortcut “R”.
To go from one Doubted Range to the next use the left/right arrow keys.

Auto Scroll

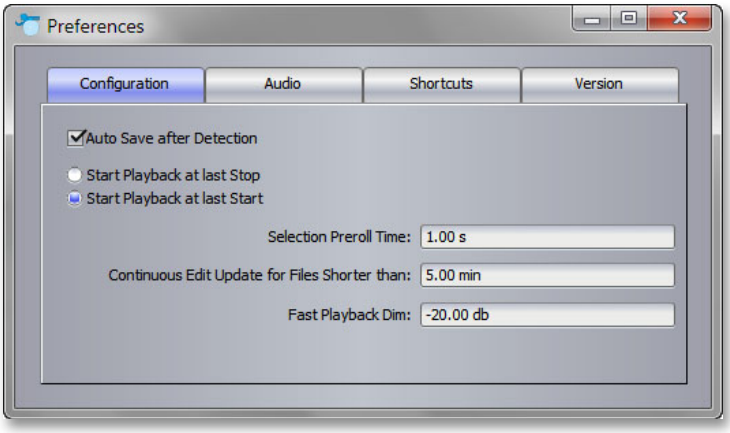
Auto Scrolling will make the waveform and Speed Curve display follow the playhead cursor. It can be activated and deactivated with the shortcut “A”.
Please note: Auto Scrolling will be turned off temporarily as long as you have selected a range for editing.

Preferences

The Preferences window offers several tabs, each with a number of options governing the behavior of Capstan. All settings done here will be the same for each document and for every program start. When you change any of the Preferences settings, these changes will remain permanent for all upcoming program starts – unless, of course, you change them again.

Open the Preferences window in the Help menu (Windows) or the Capstan menu (Mac).

Configuration tab



The Configuration Tab in the Preferences window

Auto Save after Detection
When this option is checked, Capstan will save a *.capstan file containing the result of the analysis, that took place upon loading the raw audio file. You can open multiple files at once to run the detection as an unattended batch process. The results will be automatically saved.

Start Playback ...
Here you choose, which behavior you prefer when starting playback via the Space Bar after Capstan was stopped: should the next playback continue from where you just stopped or should it play back from the same position as it did the last time?

Please note: The behavior, you did not choose here, will automatically be triggered by Alt-Space (or whatever key you defined for this in the Shortcuts tab).

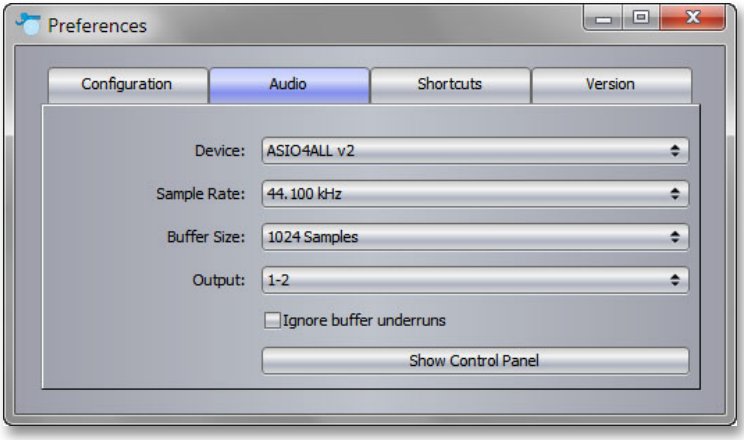
Selection Preroll Time
When a range is selected in the main window, the next playback will start at the beginning of this range. You can, however, define a Preroll time, to let the playback start a few seconds before the beginning of that range.

Continuous Edit Update ...
When editing the Speed Curve your changes are reflected immediately, since the blue curve gets redrawn permanently while you work on it or on the Intensity or Smoothing Curves. This redrawing takes some processing power and, depending on the length of your audio file and depending on the power of your computer, the permanent update of the curve may feel sluggish. For such cases you can define a maximum file length, forcing Capstan to only do permanent redrawing on files that are shorter than this maximum. When your file is longer, you will notice that – while dragging any of the curves – the blue Speed Curve doesn't change and it is gray until you release the mouse. This is, however, only an optical issue; the audio result will always be real-time.

Fast Playback Dim
When playing back fast, using the Shortcuts "J" and "L", the playback level will be dimmed by an amount, that you can set here.

Audio tab

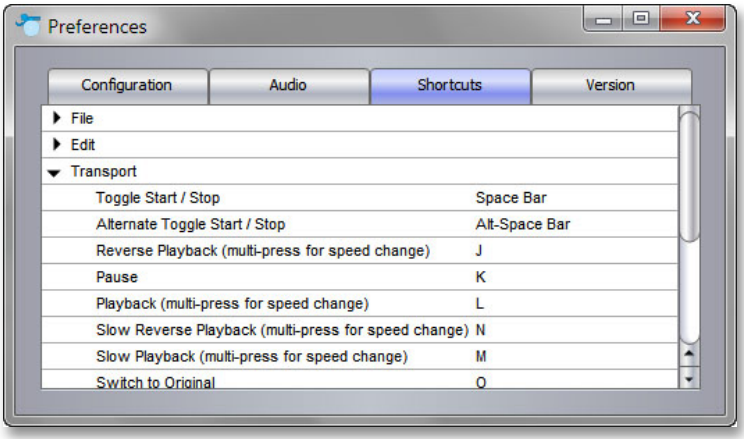
Here you choose the audio driver and specify its settings.



Setting up the audio driver in Preferences>Audio

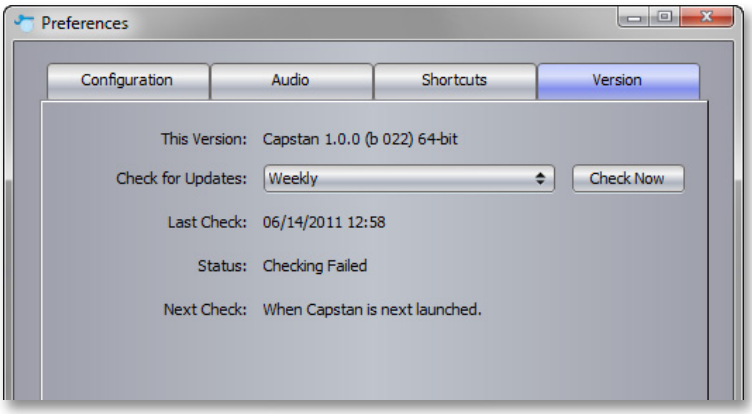
Shortcuts tab

Here you define shortcuts. Each function has a pre-set shortcut. To change this default, click on the function and, while it is highlighted, type in the new shortcut you want to specify. You may use any single key or a combination of it with one or more modifier keys (Shift, Alt, Ctrl or Cmd).



Defining Shortcuts in Preferences>Shortcuts

Version tab



Looking for updates in Preferences>Version

This Version
A display of your current version. In case you need assistance from our support team, they may ask you for the information displayed here.

Check for Updates
When your computer is connected to the internet, you can check, whether your Capstan version is up-to-date. You may set an interval (daily, weekly, etc.) for Capstan doing an automatic check. Or you use “Check Now” to find out right away if a new version is ready for download. If there is a new version available, you will be guided onscreen through the downloading process.

Last Check, Status, Next Check
Here you can see when the last update check did happen and when the next check will be performed.